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## A LOW IRON EPIDOTE FROM PORCUPINE

E. L. BRUCE AND C. W. GREENLAND, *Queen's University*

A fibrous mineral found in a vein in the Rochester mine at Porcupine was found, on optical examination, to agree closely with the rather rare variety of epidote to which the name *fouqueite* has been given.

The wall rock of the vein is a fine-grained dacite which is probably tufaceous, but the rock has been heavily impregnated by carbonates and so severely metamorphosed that its original features are completely obliterated. The vein has well-defined



VEIN AT 925 FOOT LEVEL, ROCHESTER MINE, PORCUPINE.

The fibrous mineral above the pick is epidote.

walls and the vein solutions have affected the walls and included fragments of it only to produce some induration and silicification for distances of an inch or less from the vein. The sample of epidote was taken from the vein at a depth of 925 feet. The same species occurs at the surface on the Moneta property and in diamond drill cores from beneath Gillies Lake.

The minerals associated with the epidote are quartz, calcite and chlorite, with some stains of hematite. Specimens from the Moneta occur with a pink mineral that is probably axinite. In the Rochester vein quartz and epidote seem to have crystallized almost simultaneously. Calcite is somewhat later since it fills the interstices of the others. The chlorite is light green in color and occurs in very fine scales so that it presents a granular appearance.

The epidote forms aggregates of coarse radiating fibers or needles from an inch to six inches in length, presenting an appearance somewhat similar to the striated, columnar habit of tourmaline. The color is greyish green. The mineral has a waxy lustre and is translucent. There seems to be one good cleavage as many of the fragments examined under the microscope had the same orientation and were probably resting on a good cleavage face. The hardness is above that of orthoclase but no effect could be observed on attempting to scratch quartz. The specific gravity is 3.23.

Pure material for chemical analysis was somewhat difficult to obtain for particles that appeared homogeneous to the naked eye were found under the lens to contain a considerable amount of calcite or quartz in the re-entrant angles between the needles. The material was, therefore, crushed coarsely and sorted under a lens.

The following results were obtained on analysis:

	Per cent	Combining ratio	
Loss on ignition	2.71	.150	.150 = 1.38
SiO <sub>2</sub>	39.42	.653	.653 = 6.00
Al <sub>2</sub> O <sub>3</sub>	28.38	.278	.313 = 2.88
Fe <sub>2</sub> O <sub>3</sub>	5.59	.035	
FeO	.91	.012	.437 = 4.02
CaO	22.14	.395	
MgO	1.22	.030	
	100.37		

(Analyst G. D. Furse.)

The composition of the mineral, therefore, approximates that commonly accepted for epidote,  $H_2O.4RO.3R_2O_3.6SiO_2$ .

The absence of well developed crystals in the specimens examined makes the determination of the orientation uncertain. Some of the fragments, however, are lath-shaped with extinction parallel to the elongation. In some other fragments a good cleavage can be observed which is not parallel to the extinction direction.

The crystal system is evidently, therefore, monoclinic and the elongation of the fibres is probably parallel to the ortho axis. Assuming this to be the case, the best cleavage is in the zone parallel to this axis and may be assumed to be basal.

In the examination of crushed fragments of the mineral most of the fragments rest upon the good cleavage face. The interference figure for such a section is biaxial with one axis emerging nearly normal to the cleavage face. There is strong dispersion  $\rho > \nu$ . In fragments which show lath shapes, the optic axial plane is normal to the elongation and is, therefore, probably parallel to the 010 face. The mineral is negative and the mean index of refraction is 1.72.

Although the low index of refraction agrees with the index of the variety of epidote given the species name *fouqueite* by Lacroix,<sup>1</sup> comparison with his original description shows that there are marked differences. In the analysis of *fouqueite* no  $\text{Fe}_2\text{O}_3$  is recorded, although  $\text{FeO}$  in one variety of *fouqueite* was found to be 4.4%. Lacroix found *fouqueite* to be positive, whereas the Porcupine mineral is negative.

The Porcupine mineral is probably more nearly like a white epidote from Tierra del Fuego, described by Lacroix,<sup>2</sup> although the analysis of that specimen shows a higher percentage of alumina and the iron is recorded as entirely ferrous. Lacroix remarks that the mineral resembles *zoisite* in appearance but that its crystallization and optical properties are those of epidote.

It seems likely that this low iron variety of epidote at Porcupine must have crystallized from vein forming material simultaneously with the quartz. Any inclusion of the basic wall rocks metamorphosed by solutions would seem necessarily to be higher in iron than the Porcupine epidote.

## BORNITE AS A FURNACE PRODUCT

F. N. GUILD, *University of Arizona*

During the latter part of 1923, the writer's attention was called to some crystalline material obtained from the partly fused mass of one of the smelter furnaces of the International Smelting Co., Miami, Arizona. The material was found by Mr. Emrich, assistant superintendent, while engaged in dismantling one of the furnaces.

<sup>1</sup> Bull. Soc. franc. Min., **XII**, p. 327.

<sup>2</sup> Bull. Soc. franc. Min., **X**, p. 150.



The crystals appeared as incrusting fused material and filling cavities. Many crystals extending into the cavities were so loosely attached that on handling they easily broke free, forming a granular mass consisting of distorted but well developed crystals. These averaged about a millimeter in diameter. Elongated dodecahedrons with modifications by the cube seemed to be the predominant forms. They had already been identified from a chemical analysis as bornite by Mr. F. G. Hawley, chief chemist of the company, who sent the material to the writer for crystallographic identification. Mr. Hawley suggests the possibility of the limestone flux, contained in the partly fused material, having been concerned in the development of the bornite. This may be indirectly true as the presence of unfused material would assist in the formation of cavities, as would also the escape of carbon dioxide from the reacting mixture. Another important factor in the development of the crystals has been the undisturbed condition of the material, the product having been found along the side of the furnace where the charge may have been unmolested for months. The crystals then have probably been segregated by the long continued action of the gases from the reacting mixture.

Synthetic bornite, both as a furnace product and as the result of definite laboratory experiments, has been frequently described, though in more recent years there seems to have been some doubt expressed as to its formation directly from a fused mass. In 1855 Böcking<sup>1</sup> obtained bornite as a regulus by heating together copper, iron and excess of sulphur under a cover of common salt. Marigny<sup>2</sup> also obtained it by heating pyrite, copper and sulphur under a borax cover. The product was described as a crystalline aggregate. Doelter<sup>3</sup> obtained it without melting, by the action of hydrogen sulphide on a mixture of copper and iron oxides. The bornite appeared, mingled with other sulphides, in the form of aggregates of small cubes. It was thought that these had formed at a temperature of from 100 to 200 degrees. As a furnace product it has been observed by Ruess<sup>4</sup> at Trautenau in Bohemia, together with chalcopyrite in a semi-fused silicious aluminous mass mixed with slag. A. N. Winchell<sup>5</sup> found it with chalcopyrite as a product of

<sup>1</sup> Inaug. Diss., Göttg., 29, 1855. Also Hintze, *Mineral.*, 1, 914.

<sup>2</sup> *Compt. Rend.*, 58, 967, 1864.

<sup>3</sup> *Zeit. f. Kryst.*, 11, 36.

<sup>4</sup> *N. Jahrb.*, 79, 1861.

<sup>5</sup> *Am. Geologist*, 28, 244, 1901.

the furnaces at Butte, Montana. It was thought that here it may have been produced by sublimation. It has further been noted in small crystals as an alteration product on Roman coins in various hot springs where it was associated with chalcopyrite.<sup>6</sup>

From a consideration of the above facts, it would seem that bornite has developed both from the condition of dry fusion and lower temperature conditions, though in the former case it is doubtful whether the mineral formed directly on consolidation of the fused mass or by subsequent transformations in the solid state. These transformations, although possibly of various types, may all roughly be grouped under the term of unmixing. Doubtless the presence of gases and solutions assist in the unmixing process. The study of equilibrium curves between cuprous sulphide and iron sulphide has yielded different results in the hands of various workers. Some have reported that various compounds result between the two limits, while others<sup>7</sup> have found a series of mixed crystals with an eutectic range. In the interpretation of results it should be remembered that a microscopic study when taken by itself records only the final results, after transformations in the solid state, if sufficient time has been given, have brought about a new state of equilibrium. On the other hand, a thermo-analysis of the system usually gives only the result of the state of equilibrium at the point of crystallization from a molten mass. In most cases the transformations that take place in the solid state are too slow for detection by thermochemical means. The possibilities of alteration after consolidation has taken place are much greater than the simple unmixing of the two or more components. There is the possibility, (a) of the formation of polymorphous forms at lower temperatures. These may enter into different states of equilibrium than the original form. Thus one of our compounds,  $\text{Cu}_2\text{S}$ , is known to exist as isometric at certain temperatures while it becomes orthorhombic at lower temperatures. It is reasonable to suppose that the orthorhombic form would enter into different kinds of combination than the isometric. (b) Peaks on a curve representing the formation of double salts may occur at various places below the temperature of consolidation, all representing transformations taking place in the solid condition. These would all show under

<sup>6</sup> Daubrèe, *Compt. Rend.*, **80**, 461, 1875, and **81**, 182. Lacroix, *Min. de France*, **2**, 677, 1897.

<sup>7</sup> Carpenter and Hayward, *Eng. and Min. Jour. Press*, **115**, 1055, 1923.



microscopic study a structure suggestive of an unmixing of the constituents or an eutectoid intergrowth. The formation of these compounds (peaks on the curve) cannot be determined by thermochemical means as the transformation points take place too slowly. By identifying the compounds on polished surfaces by means of the microscope an hypothetical curve may be constructed, the peaks of which represent definite compounds or double salts. These are located below the curve found by thermo-analysis and though the temperature of unmixing cannot be determined at present, they may be sketched in showing the probable result. Some of these transformations have been fairly well worked out by the metallographists especially in the case of the iron-carbon system.

Carpenter and Hayward<sup>8</sup> have recently shown by thermo-analysis that no compounds form in the system  $\text{Cu}_2\text{S} - \text{FeS}$  at the temperature of consolidation. Therefore the compounds recognized by the microscope in a copper matte must have resulted from an unmixing after solidification. Thus in our specimen of furnace bornite, the massive matte with which it was associated showed intergrowths between bornite and chalcopyrite similar to those found in some ore deposits. These natural intergrowths have been the subject of much discussion in the microscopic study of ores, some holding to the view of simultaneous deposition, others to secondary replacement along crystallographic or less regular directions, while still others favor the theory of unmixing. The last view is favored by Dr. Hans Schneiderhöhn,<sup>9</sup> perhaps the chief exponent of "Chalcographic" methods in Germany. He has outlined, after the method of the metallographer, some of the changes that might take place after deposition.

If the sulphide ore deposit could be looked upon as an injected mass of fused material,<sup>10</sup> then the principle of unmixing would be almost as good as established, as many cases of the phenomenon have been observed in the laboratory with fused melts. These show a characteristic structure (eutectoid) like that often met with in ore deposits. Since, however, many of us are unable as yet to

<sup>8</sup> *Loc. cit.*

<sup>9</sup> Entmischungsscheinungen innerhalb von Erzmischkrystallen und ihre Bedeutung für Lagerstättenkunde und Aufbereitung. *Metall und Erz*, XII, 501, 517, 1922. Anleitung zur mikroskopischen Bestimmung und Untersuchung von Erzen und Aufbereitungsproducten besonders in auffallenden Licht. *Berlin*, 1922.

<sup>10</sup> Spurr, J. E., *The Ore Magmas*, 1923.

accept this as a working hypothesis, the strong point in the theory of unmixing, viz:—the idea of an initial melt, is lacking. This presents a real difficulty for which no satisfactory explanation seems available.

## FURTHER NOTE ON SARCOPSIDE

EDW. F. HOLDEN, *University of Michigan*

In 1920 the writer described sarcopside from Deering, N. H., the second known locality for that mineral.<sup>1</sup> Since then further details regarding sarcopside and its associated minerals have been noted, and they are given in this supplementary paper.

Websky,<sup>2</sup> in describing the original sarcopside from Michelsdorf in Silesia, did not give its optical properties. Mr. W. A. Roebling very kindly lent the writer a specimen of Silesian sarcopside for comparison with the Deering mineral. The two are identical in optical properties, that from Michelsdorf having  $n$  approximately 1.72, agreeing very closely with the value previously given for the New Hampshire specimens, 1.725. Under the microscope, however, Websky's mineral was found to contain bluish and greenish altered areas scattered through the colorless sarcopside, while the American specimens are much purer. This is also indicated by the analyses as given in the writer's previous paper. The iron of the New Hampshire sarcopside is nearly all in the ferrous state (39.87% FeO, 1.70% Fe<sub>2</sub>O<sub>3</sub>) while Websky's analysis shows a larger proportion of ferric iron (30.53% FeO, 8.83% Fe<sub>2</sub>O<sub>3</sub>), which is undoubtedly due to alteration. A further difference is that the sarcopside from Michelsdorf occurred in small confused aggregates not exceeding an inch in diameter, while, as noted below, the mineral from the newer locality has been found in pieces as large as a foot in length, with a straight fibrous structure.

Since the New Hampshire occurrence was first described more blasting has been done by the Gingrass brothers, who own the prospect. This has uncovered several large pieces of sarcopside, one of which was about three decimeters long and one decimeter in diameter. Unfortunately most of these newer specimens have

<sup>1</sup> Edw. F. Holden. An American Occurrence of Sarcopside. *Am. Min.*, **5**, 99-102, (1920).

<sup>2</sup> M. Websky. *Z. Deutsche Geol. Ges.*, **20**, 245, (1868); abstracted in *Jahrb. Mineral.* 606, (1868).



suffered alteration along cleavage cracks. They must have lain near the surface of the rock in the excavation for about ten years, the period which elapsed before blasting was resumed. But it was possible to break out many good specimens from these pieces. Previous to this only two small fragments,  $3 \times 3 \times 2$  and  $2 \times 2 \times 1$  cm. had been found.

Several interesting iron phosphates were associated with the more recently discovered sarcopside. Two of these were alteration products of that mineral. The alteration is largely a process of oxidation of the ferrous iron of pure sarcopside. The first change is to bluish and greenish spots which contribute the ferric iron shown by the analyses. The next product is a granular dark blue mineral, a ferro-ferric hydrated phosphate resembling "blue vivianite". The final stage of alteration is to an amorphous yellowish brown mineral encrusting the sarcopside. It is a hydrated ferric phosphate, containing some ferrous iron, but not as much as is in the blue mineral, judging from qualitative tests. This substance has  $n=1.67-1.68$ . It is evidently related to the poorly defined amorphous ferric phosphates such as koninckite ( $n=1.65$ )<sup>3</sup>, picite and delvauxite.

In the pegmatite near the sarcopside were radiating fibrous layers of dufrenite of brown to greenish black color. It was identified by qualitative chemical tests, and by some of its optical characters. Tests were obtained for both ferrous and ferric iron, a trace of manganese, water, and phosphoric acid. The value for  $n$  was greater than 1.74; the elongation of the fibers was negative. Pleochroism was somewhat variable, generally it was: X, yellow to yellowish brown; Y, light to dark olive green; Z (normal to the cleavage), undetermined. Some fragments showed: X, yellow to brownish yellow; Y, greenish brown to dark brown. Extinction was parallel to the fibers. These characters agree with those of Larsen's type A dufrenite, with small  $2V$ .<sup>4</sup>

In thin layers between the bands of dufrenite, and scattered through the rock near the dufrenite, was a finely fibrous, yellow mineral having the following properties: composition, hydrated ferric phosphate, some ferrous iron present; elongation +; pleochroism, dark yellow parallel to the fibres, light yellow across the fibers; extinction parallel; indices of refraction 1.700 and 1.720

<sup>3</sup> E. S. Larsen. The Microscopic Determination of Non-opaque Minerals. *U. S. Geol. Surv. Bull.* **679**, 176, (1921).

<sup>4</sup> Larsen, *ibid.* 69.



(+.005). This agrees with cacoxenite except that the indices are much too high, compared with those given by Larsen<sup>5</sup>, 1.58 and 1.64. But cacoxenite is variable in both composition and optical properties, according to Doelter.<sup>6</sup> Larsen states that some of the fibers on a specimen from Saxony, especially near the ends, have considerably higher indices of refraction. A variation in water content might easily cause marked differences in indices. Cacoxenite has been recorded as occurring with dufrenite. Evidently this mineral, which occurs in too small quantities for chemical analysis, is either related to or identical with cacoxenite.

It can hardly be doubted but that a closer examination of many New England pegmatites would reveal the presence of more of these unusual phosphates.

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## A CONVENIENT METHOD FOR CHECKING THE INDEX OF A LIQUID

RALPH L. RUTHERFORD, *University of Alberta*

Liquids for determining the indices of minerals are used very extensively in petrographic investigation, especially in the study of crushed minerals and cleavage fragments. For such purposes it is essential to have liquids whose indices are known or can be easily determined. The greater number of the easily obtainable liquids for such purposes suffer changes in index through volatilization and must, of necessity, be checked before using when accurate results are desired. The check can be made by refractometers but in many smaller laboratories these are not readily available.

Powdered glass has been used by the writer for some time as a substitute for the refractometer. The glasses of known index can be obtained for a reasonable price from lens and optical glass manufacturers. A convenient form for usage is the powder which can be kept in small bottles with the index marked on the container similar to "index liquid" bottles. A still more convenient container is one with a sieve-cap of fine mesh, resembling a salt or pepper shaker, from which a small amount of the powder can be easily removed for use.

The writer has found it most satisfactory to screen the powdered glass into three sizes, namely: 100-150, 150-200, and 200-250.<sup>1</sup>

<sup>5</sup> Larsen, *ibid.* 51.

<sup>6</sup> C. Doelter. *Handbuch der Mineralchemie*, 3, pt. 4, 534, (1914).

<sup>1</sup> Standard screen mesh.

The screening removes any dust and also particles which are too large, thus giving a uniform size of powder.

In using liquids that are subject to rapid volatilization the powdered glass may be placed beneath the cover glass with the mineral fragments. In this way the liquid may be constantly checked as to change in index while the actual determination of an index of the mineral is being made. This seems to be the most valuable use of the glass because the check is made on the liquid which is in contact with the mineral and not on another portion of the liquid which must be used for a refractometer.

In the above method it is best to screen the mineral fragments and use glass powder of a different size to avoid confusion of the glass and the mineral. In most cases this would be unnecessary since the glass is colorless and isotropic but in determining the index of an isotropic mineral it is better to use the different sizes.

The glass manufacturers state that the index of the glass does not vary within the melt nor with time, to any appreciable degree that would affect the above usage. The accuracy to which determination of index can be made depends upon the investigator's ability to distinguish small differences in index by use of the "Becke line" or "inclined illumination," methods.

Undoubtedly others have resorted to similar methods of checking index liquids but so far as the writer knows this method has not been mentioned in the literature.

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## THE PRESENT STATUS OF THE MINERAL REMINCTONITE<sup>1</sup>

EARL V. SHANNON, *U. S. National Museum*

The mineral remingtonite, supposedly a hydrous cobalt—carbonate, was described by J. C. Booth in 1852 from the old mine at Finksburg, Carroll County, Maryland. The composition was based upon qualitative tests, the mineral being considered a carbonate because of a slight effervescence when it was treated with hydrochloric acid. It occurred associated with carrollite as a rose red, very thin coating on serpentine.

<sup>1</sup> Published by permission of the Secretary of the Smithsonian Institution. The present paper is the third of a series of preliminary papers on the minerals of Maryland which are being studied in cooperation with the Maryland State Geological Survey.



In the course of the writer's investigations on the minerals of Maryland a persistent effort has been made to obtain an authentic specimen of this mineral from this locality. Finally a specimen labeled remingtonite from this locality, from the Brush Collection of Yale University, was loaned by Prof. W. E. Ford. This is described as follows:

The specimen (Brush Coll. No. 2906) is a porous mass of crystalline magnetite. The cavities are largely lined with a translucent botryoidal coating of the "remingtonite" which overlies brilliant minute octahedral crystals of magnetite which has a few included grains of "carrollite". The crust of the supposed remingtonite in the best cavity is about .25 mm. thick and is deep purplish-pink in the interior and brownish-pink to brown outside. Elsewhere the botryoidal coating varies through various shades of brown to pale green.

Fragments of the material showing the most intense pink color when immersed in dilute (1:1) and concentrated hydrochloric acid did not effervesce at all and retained their original form but were decolorized, the pink color leaching out and, in concentrated acid, giving the characteristic rich, blue-green color of cobalt.

Under the microscope in polarized light the mineral is transparent and colorless, and consists of metacolloidal, sub-microscopic fibers giving the usual black extinction cross. The fibers have parallel extinction and a positive elongation. The indices are somewhat variable with  $\alpha = 1.535$ ,  $\gamma = 1.543$ ;  $\gamma - \alpha = 0.008$ .

There seems little doubt but that this material is a serpentinous substance colored by cobalt, possibly a cobalt stained serpentine or a cobalt equivalent of garnierite.

The existence of a hydrous cobalt—carbonate corresponding to the supposed remingtonite has not been conclusively demonstrated. Several occurrences of supposed remingtonite have been proven to be erythrite. The data given by Larsen for remingtonite from Lower California seem to indicate an anhydrous carbonate of the rhombohedral group, possibly cobaltiferous smithsonite.

It is highly desirable that any further specimens of supposed remingtonite from Maryland be examined and the writer would be very pleased to obtain the loan of any that may exist in collections. The locality has been thoroughly gone over without finding anything resembling this mineral.

## PROCEEDINGS OF SOCIETIES

### NEW YORK MINERALOGICAL CLUB

*Annual Meeting of April 16, 1924*

The thirty-seventh annual meeting of the New York Mineralogical Club was held in the Morgan Memorial Hall of the American Museum of Natural History on the evening of April 16, 1924. The president, Dr. George F. Kunz, presided. Fifteen members were in attendance. The minutes of the last meeting were read and approved. The secretary called the attention of the Club to the recent death of Mr. George S. Scott, a former active and enthusiastic member and one whose loss will be greatly felt. On motion of Mr. Stanton the president appointed a committee consisting of Messrs. Hoadley, Findlay and Whitlock to frame fitting resolutions to be presented to Mr. Scott's family.

The committee on the Gratacap Memorial submitted a full-sized detail of a design as approved in size, text and lettering by the Museum authorities. The authorities also gave approval for light colored marble, of harmonious tone with the interior color of the Hall, as the material for the tablet. The treasurer was authorized to issue appeals for funds to meet the cost of this Memorial.

Mr. Stanton moved that the treasurer of the Club be authorized to approach the heirs of the late Dr. Levison, through Mr. Ashby, making an offer to the effect that the Club publish the Levison bibliography at a cost of \$50.00 on condition that the heirs donate to the New York Mineralogical Club, the New York City chrysoberyl specimen from Dr. Levison's collection to be placed on permanent exhibition. The motion was carried. Mr. Stanton moved that a contribution of New York City minerals be made by the Club for the New York City Museum from the Chamberlain Collection of duplicates.

The treasurer submitted a report for the year showing a balance of \$581.13. The president appointed Messrs. Ashby and Allen as a committee to audit the treasurer's Report. The nominating committee submitted the following nominations for officers for the ensuing year:

For President	George F. Kunz
For 1st Vice President	Frederick I. Allen
For 2nd Vice President	George E. Ashby
For Treasurer	Gilman S. Stanton
For Recording Secretary	Herbert P. Whitlock
For Corresponding Secretary	Roy M. Allen

The president then vacated the chair having appointed Mr. Collins as temporary chairman. The motion was then carried that the above nominees be elected by acclamation, and they were so elected. The president on resuming the chair called upon Mr. English to relate some of his recollections of *Collectors and Collections*.

Mr. English mentioned some very interesting facts relating to the disposal of the Spang Collection. He also described a collecting trip which he made in 1891 to Laurium and to Girgenti, also a visit to the island of Elba and the Carrara quarries. Dr. Kunz described a trip to Florence for the collection of tourmalines. He also recalled some interesting facts about the Spang Collection and related some anecdotes of the late Dr. Ward of Rochester.



Mr. Broadwell suggested arranging a trip for Decoration Day, and mentioned French Creek as a possible objective. A committee consisting of Messrs. Broadwell, Hoadley, Manchester and Capt. Miller was appointed to arrange the details of this excursion. The meeting then adjourned.

HERBERT P. WHITLOCK, *Recording Secretary.*

#### *Regular Monthly Meeting of May 14, 1924*

A regular monthly meeting of the New York Mineralogical Club was held in the East Assembly Room of the American Museum of Natural History on the evening of Wednesday, May 14, at 8:15 P. M. The Vice President, Mr. George E. Ashby, presided and there was an attendance of 21 members.

The minutes of the last meeting were read and approved. The committee on the George S. Scott resolution reported that the resolution was in preparation and would be forwarded to the relatives of Mr. Scott before the next meeting. The committee on the Gratacap Memorial reported that the matter had been placed in the hands of Dr. Kunz.

In reporting for the outing committee, Mr. Broadwell recommended Branchville, Conn., as an objective for the Memorial Day field trip. On a motion by Mr. Manchester the Club voted in favor of the Branchville objective. Mr. Wintringham called attention to several articles on luminescence of minerals and color in minerals.

The vice president then introduced Mr. Samuel G. Gordon of the Philadelphia Academy of Sciences who spoke on the *Second Vaux-Academy Expedition*. Mr. Gordon described the objects and results of this expedition to Greenland in 1923 and reviewed some of the work of mineral collectors in this most interesting field, mentioning particularly the visit to Julianshaab by Giesecke who made the first collection of minerals from Greenland. Mr. Gordon's expedition made its first base at Julianshaab and visited the localities among the fiords of the west coast collecting practically all of the rare species from these localities. The speaker illustrated his talk with a great many lantern slides and by the use of numerous fine specimens of the Greenland minerals which he collected on this expedition.

At the close of his address a vote of thanks was tendered to Mr. Gordon for his valuable contribution to the knowledge of these little known localities.

HERBERT P. WHITLOCK, *Recording Secretary.*

## NEW MINERALS: NEW SPECIES

CLASS: SILICATES. DIVISION:  $R''' : Si = 3 : 2$ .

### **Mullite**

N. L. Bowen, J. W. Greig and E. G. Zies. Mullite, a silicate of alumina. *Jour. Wash. Acad. Sci.*, **14**, 183, 1924. Also *Jour. Amer. Ceramic Soc.*, April, 1924.

NAME: From the Island of *Mull*, Scotland, the locality from which it was first identified.

CHEMICAL PROPERTIES: An anhydrous silicate of alumina,  $3Al_2O_3 \cdot 2SiO_2$ ;  $SiO_2$  29.04,  $Al_2O_3$  69.63,  $Fe_2O_3$  0.50,  $TiO_2$  0.79,  $Na_2O$  0.18,  $K_2O$  0.06, sum 100.20. Theory,  $SiO_2$  28.2,  $Al_2O_3$  71.8. Unattacked by acids including hydrofluoric acid.

CRYSTALLOGRAPHIC PROPERTIES: Orthorhombic prisms.  $m \wedge m = 89^\circ 13'$ . Cleavage parallel to (010).

PHYSICAL AND OPTICAL PROPERTIES: Colorless to delicate pink in mass.  $\alpha=1.642$ ,  $\gamma=1.654$ .  $2V=45^\circ - 50^\circ$ .  $c=\gamma$ ,  $b=\alpha$ . Low titanium specimens are not pleochroic, a higher content of titanium raises the indices and the mineral becomes pleochroic in shades of pink.

OCCURRENCE: Found in fused argillaceous inclusions in Tertiary eruptive rocks of the Western Isles of Scotland. Occurs as abundant prisms associated with rare plates of corundum. It is also abundantly developed in many artificial melts and in porcelains, being the material usually called sillimanite. Its similarity to sillimanite is very great. The 3:2 compound, mullite, is the only one stable above  $1000^\circ$ . Mullite should be found in contact rocks that have been highly heated.

DISCUSSION: The discovery of mullite is a striking example of the application of physical-chemical methods to mineralogy. The mineral was first noted in artificial preparations and later sought for in argillaceous rocks that had been subjected to a high heat.

W. F. FOSHAG

## DOUBTFUL SPECIES

### Fourmarierite

H. Buttgenbach: La Fourmari rite, nouvelle esp ce min rale. *Ann. soc. geol. Belg.*, p. 41, 1924.

NAME: In honor of the geologist, P. *Fourmari r*.

CHEMICAL PROPERTIES: Exact composition unknown. Contains uranium, lead, water and perhaps silica. Soluble in acids, gives water in closed tube. Before the blow-pipe infusible but blackens.

CRYSTALLOGRAPHIC PROPERTIES: Orthorhombic.  $a:b:c=0.8832:1:0.8115$ . Forms, (100), (110), (111).

PHYSICAL AND OPTICAL PROPERTIES: Color red, brownish yellow in thin section. Pleochroic in shades of yellow. Luster adamantine. Sp. Gr. 6.046.  $H=3-4$ .  $n$  higher than 1.754. Plane of the optic axes parallel to (001).

OCCURRENCE: Found at Chinkolobwe, Katanga, Belgian Congo, associated with torbernite, kasolite and curite as an alteration product of pitchblende.

DISCUSSION: This is apparently a new species but its chemical composition and more complete optical data need still to be determined.

W. F. F.

## NOTES AND NEWS

Professor Esper S. Larsen, Jr., of Harvard University has been appointed representative of the Mineralogical Society of America on the National Research Council, Division of Geology and Geography, in place of Dr. Edgar T. Wherry, who has served for three years.

The Leibniz Silver Medal, for 1924, of the Prussian Academy of Sciences has been given to Fraulein Lisa Meitner, professor of physics at the Kaiser Wilhelm Institute in Dahlem, near Berlin, in recognition of her researches on radium.

D. B. Dow, of the Petroleum Experiment Station of the Bureau of Mines, has been appointed engineer in charge at the new station now being established at the University of Wyoming.



Henry C. Berger has resigned from the research staff of the U. S. Bureau of Mines to assume the position of research chemist for the Armstrong Cork and Insulation Company of New Jersey.

The Bureau of Mines radium laboratory has been transferred to Washington, D. C., from Reno, Nevada. This change was made so that the work could be under the personal direction of Dr. S. C. Lind.

According to *Chemical and Metallurgical Engineering* an appropriation of \$90,000 will be asked of Congress next December by the Bureau of Mines, for the purpose of establishing a plant in the field for the extraction of oil from shale. The appropriation is to cover the construction of the plant, the land necessary for the plant and the shale.

On July 1 the metric system became the official standard of measurement in Japan and was so announced in an imperial ordinance, according to the Department of Commerce.

Material labeled muscovite and sold recently by V. W. Field of Salt Lake City, Utah, has been shown by Mr. Earl V. Shannon to be a variety of chlorite (penninite). Mr. Field has requested this note in order that those who purchased this material might be informed.

Mr. P. Walther of the Newark Mineralogical Society has recently secured several specimens of *crystallized* native iron. The material came from Madoc Co., California, and is of special interest because of its crystallized condition. The forms observed are, octahedron, cube, combination of octahedron and cube, pentagonal and rhombic dodecahedrons. Upon analysis 97.707% Fe was noted. The sp. gr. is 7.31.

Among those who received honorary degrees from the University of Liège, at the conclusion of the meetings of the French Association for the Advancement of Science, were Dr. Lacroix, secretary of the Paris Academy of Sciences, and Dr. Charles Barrois, professor of geology and mineralogy at Lille.

Dr. Oliver W. Huntington, formerly instructor of mineralogy at Harvard University, has died, aged sixty-five years.

Dr. E. S. Dana of Yale University has been elected corresponding member of the Vienna Academy of Sciences.

According to *Science Service* a new process for the fixation of atmospheric nitrogen was described before the chemical section of the British Association for the Advancement of Science. When a mixture of carbon monoxide and air is exploded in a bomb under one hundred atmospheres of pressure, the heat produced is absorbed by the nitrogen and rendered so active that it will unite with some of the oxygen of the air. From the oxides of nitrogen, nitric acid or nitrates can be derived.

## ABSTRACTS

PRELIMINARY NOTES ON THE ACTION OF SILVER NITRATE SOLUTIONS ON PYRITE AND MARCASITE. KAMEKI KINOSHITA. *J. Geol. Soc. Tokyo*, **28**, 423-31 (1921); through *Japn. J. Geol. Geog.*, **1**, 6-8 (Abstr.).

The dimorphous sulfides, pyrite and marcasite, may be distinguished by the following test: When marcasite is boiled in a 3%  $\text{AgNO}_3$  solution, its surface tarnishes to tobacco-brown, then red, and finally blue, while pyrite becomes only slightly brownish. In the reaction ferrous sulfate, sulfuric acid, and basic ferric sulfate are formed, but in different proportions for the two minerals. E. F. H.

CORDIERITE FROM JOTSU-RI, SHIMO KISEN-MEN, KANKYO-NANDO, KOREA. IKUO KOMADA. *J. Geol. Soc. Tokyo*, **29**, 120-1 (1922); through *Japn. J. Geol. Geog.*, **1**, 19 (Abstr.).

Good crystals of cordierite occur in granite-gneiss. The color is brown to yellowish-brown, the luster resinous. The prismatic crystals reach a length of 5 cm. The forms *a*, *b*, *c*, *d*, *m* are developed. E. F. H.

HARMOTOME FROM UDO, SHIMANE PREFECTURE. KAMEKI KINOSHITA. *J. Geol. Soc. Tokyo*, **29**, 83-9, (1922); through *Japn. J. Geol. Geog.*, **1**, 19 (Abstr.).

Harmotome occurs as typical penetration twins in fissures in green tuffs, with calcite, laumontite, pyrite, chalcopyrite, sphalerite. Well developed forms are *a*, *b*, *c*, *m*. It is colorless to white. Analysis gave:  $\text{SiO}_2$  45.7,  $\text{Al}_2\text{O}_3$  15.7,  $\text{BaO}$  18.3,  $\text{H}_2\text{O}$  16.3,  $\text{CaO}$  1.6,  $\text{K}_2\text{O}$  (diff.) 2.9. E. F. H.

GARNET FROM THE ISLAND OF OUESSANT. DEBEAUPUIS. *Bull. Soc. franc. Minéral.*, **45**, 5-7, (1922).

Grossularite and almandite occur in mica schist. Certain rose and violet, transparent, crystals are of gem quality. E. F. H.

THE ORIGIN OF EPIDOTE IN CERTAIN GRANITIC ROCKS. LOUIS DUPARC. *Bull. Soc. franc. Minéral.*, **45**, 21-7, (1922).

Primary epidote occurs in granitic rocks from Mont Blanc; and either primary or more probably from absorbed epidotic rocks, in a plagioclase granite from Syserts-kayadatcha (Ural du Sud). E. F. H.

SUPPLEMENT TO THE DETERMINATION AND STUDY OF OXIDE MINERALS. THEIR TRANSFORMATION TO SULFIDES. AD. BRALY. *Bull. Soc. franc. Minéral.*, **45**, 17-20, (1922).

It is sometimes advantageous to confirm the blowpipe reactions of oxide minerals by transforming them to sulfides and testing further. The transformation is accomplished by fusing the oxide with an excess of S, in a covered capsule. The operation is continued until the excess S is completely volatilized. E. F. H.

THE JADE OF THE TUXTLA STATUETTE. H. S. WASHINGTON. *Proc. U. S. Nat. Mus.*, **60**, no. 2409 (1922).

The Tuxtla statuette, found 100 miles s.w. of Vera Cruz, Mexico, and assigned the date 96 B. C., is described with regard to the composition and optical properties.



It contains equal amounts of the sodic jadeite and the diopside molecules; this composition seems to be characteristic of the Middle American jades, while those of Asia are nearly pure sodic jadeite.

E. F. H.

TWINS OF STAUROLITE. G. FRIEDEL. *Bull. Soc. franc. Minéral.*, **45**, 8-15, (1922).

The conclusion from a large number of measurements is that the  $69^\circ$  twinning of staurolite is best considered as being caused by a rotation of  $120^\circ$  about a ternary axis of twinning normal to the form (101).

E. F. H.

THE CHEMICAL COMPOSITION OF FASSAITE FROM HODRUSBANJA (*Comitat Hont*). VICTOR ZSIVNY, *Z. f. Krist*, **57**, 387-393 (1922).

Analysis of this fassaite gave:  $\text{SiO}_2$  48.56%,  $\text{TiO}_2$  0.57%,  $\text{Al}_2\text{O}_3$  9.06%,  $\text{Fe}_2\text{O}_3$  1.68%,  $\text{FeO}$  0.36%,  $\text{MnO}$  traces,  $\text{MgO}$  14.89%,  $\text{CaO}$  25.16%,  $\text{Na}_2\text{O}$  0.09%,  $\text{K}_2\text{O}$  0.04%,  $\text{H}_2\text{O}$  0.28%. A comparison of the above mineral with that from Fassathal discloses in the former 4.8% more  $\text{SiO}_2$ , 3.6% more  $\text{MgO}$ , 1.7% less  $\text{FeO}$ .

PAUL BOONE

CONTRIBUTION TO THE STUDY OF ISOMORPHISM. E. WIDMER. *Bull. suisse Minéral. Pétr.*, **2**, 283-9 (1922); through *Rev. Géol.*, **4**, 484.

W. discusses the indices of refraction, double refraction, specific and molecular refractivity of several isomorphous substances.

E. F. H.

SEVERAL SWISS ZEOLITE PARAGENESISES. ROBERT L. PARKER. *Bull. suisse Minéral. Pétr.*, **2**, 290-8 (1922); through *Rev. Géol.*, **4**, 484.

The occurrences of zeolites are discussed in relation to the regional circumstances. Several views are expounded with the purpose of affording a better comprehension of the paragenesis of Alpine minerals.

E. F. H.

NEW MINERALS FROM THE DOLOMITE OF CAMPO-LUNGO. F. MÜHLENTAL. *Bull. suisse Minéral. Pétr.*, **2**, 299-306 (1922); through *Rev. Géol.*, **4**, 484.

Besides the minerals already known to occur in the dolomite of Campo-Lungo (tourmaline, tremolite, phlogopite, diaspore, quartz, pyrite, rutile, zircon, talc and cyanite) M. notes two new species, scapolite and beryl; these with tourmaline indicate a pneumatolytic origin for the minerals.

E. F. H.

THE PIEZO-ELECTRIC RESONATOR. W. G. CADY. *Proc. Inst. Radio Eng.*, **10**, 83-114, 1922.

A discussion of the theory of piezo-electricity with special reference to quartz. For piezo-electric experiments, rectangular rod-like plates are usually cut from the crystals so that the longest dimension is perpendicular to a pair of prism faces, the intermediate one is parallel to the axis  $c$ , and the shortest is parallel to a lateral crystal axis emerging at prism edges. Such bars are capable of vibrating both mechanically and piezo-electrically and may be employed as resonators. When clamped to steel bars, the latter may be made to vibrate, with different frequencies. The radio wave length in meters is roughly 100 times the length of the resonator in

millimeters. Such resonators may be used as wave-length standards, as stabilizers of the frequency of electron tube generating circuits, and in other practical ways.

E. T. W.

THE COLORINGS OF SOME TYPES OF QUARTZ, AND THEIR INSTABILITY GEORGE O. WILD AND R. E. LIESEGANG. *Centr. Mineral.*, 481-3, (1922).

The idea that color changes in allochromatic minerals, brought about by heat or radiations, is due to changes in the degree of dispersion of coloring particles does not seem possible. The solid structure of crystals would hinder or entirely prevent the aggregation of such particles. Ultra-microscopic examination of heat decolorized and natural amethyst afforded no confirmation of the theory of a change in dispersity.

E. F. H.

COLLOID CHEMISTRY AND MINERALOGY. F. RINNE. *Kolloid-Z.*, 31, 269-71, (1922).

In a general way the author discusses colloid chemistry and the formation of minerals, and colloid chemistry in its relation to the process of crystallization.

E. F. H.

REMARKABLE SPECIMENS OF COPPER AND TIN MINERALS FROM KATANGA. MAX LOHEST. *Ann. Soc. géol. Belg.*, (Bull.) 45, 76-7, (1922); thru *Rev. Géol.*, 4, 22, (1923).

A large specimen of native copper, and several specimens of cassiterite penetrated by tourmaline needles are described.

E. F. H.

GALENA, ANKERITE, BARITE, AND BLENDE FROM PUERTOLLANO. JOSEPH MELON. *Ann. Soc. géol. Belg.*, 45, 151-5, 1922; thru *Rev. Géol.*, 4, 22, (1923).

Galena crystals with 11 forms support large rhombohedrons of ankerite. Small barite xls, associated with pyrite and ferruginous blende, have a larger *c:a* ratio than is usual.

E. F. H.

CELESTITE FROM THE MADREPORE LIMESTONE OF THE PROVINCE OF MESSINA. FRANCESCO RANFALDI. *Rend. Accad. Lincei, Cl. Sc. fis. mat. natur.*, 31, 430-3, 468-72, 506-8, (1922); thru *Rev. Géol.*, 4, 22-3, (1923).

Celestite xls. occur in limestone at the hill of Tremoli and in the Marre valley.

E. F. H.

RADIUM BEARING PEGMATITES OF ONTARIO. H. V. ELLSWORTH. *Geol. Survey Canada, Summary Rept. part D*, 51-70, 1922.

Pegmatites at Parry Sound, Butts Township, Craigmont-Burgess, Opeongo-Aylen Lake, and Maberley contain radioactive minerals (uraninite, euxenite-polycrase, and allanite). These minerals are closely associated with deep red feldspar and smoky quartz. A very complete analysis of uraninite from Parry Sound is used to calculate the age of the pegmatite mass in which it occurs (1,272,000,000 years).

E. F. H.